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**IEEE 802.3**

**Backplane Ethernet Study Group**

**Closing Plenary Meeting Report**

Lake Buena Vista, FL

March 18, 2004



# Plan for the Week

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- Hear presentations
  - 11 technical presentations
  - Support and refine objectives
  - Topics include system requirements, backplane channel definition, auto-negotiation, enhancements to flow control
  
- Address comments on the PAR, 5 Criteria, and Objectives.
  
- Seek 802.3 approval of PAR, 5 Criteria, and Objectives.



# Accomplishments

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- PAR, 5 Criteria, and Objectives
  - Slight modifications to the objectives
    - Clarification, conversion to metric units
    - “FR-4” to “improved FR-4”
- Presentations.
- Group formed to investigate backplane channel model.



# Presentations

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- Michael Altmann, “10 GbE Serial PHY Requirements”
- John D’Ambrosia, “Relative Cost for Backplanes and Blades”
- Mike Oltmanns, “Next Generation System Costs: A True Look”
- Joel Goergen, “Channel Model Criteria”
- Tom Palkert, “Ethernet over Backplane System Requirements”
- Bill Hoppin, “Market Drivers and Cost Considerations in Support of 40 inch average grade FR4 backplane links at 10Gb/s per lane”
- Luke Chang, “1/10Gbps Autonegotiation Schemes”
- Gopal Hegde, “Case for Enhancing Ethernet Capabilities for Backplane Fabric Interconnects”
- Manoj Wadekar, “Throughput & Latency Control in Ethernet Backplane Interconnects”
- John D’Ambrosia, “Developing a Channel Model to Include Variance”
- Stephen Anderson, “Comparison of PAM-4 and NRZ Signaling”
- *Thomas Jorgensen, “Backplane Ethernet Auto-Negotiation”*
- *Joel Goergen, “FR-4 Definition”*



# Auto-Negotiation

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- **Straw Poll:** Should Backplane Ethernet standardize
  - Optional Auto-negotiation – 33
  - Mandatory Auto-negotiation – 8
  - No Auto-negotiation – 16
  
- **Straw Poll:** Is the BESG prepared to clarify the objective concerning “Consider auto-negotiation?”
  - Y: 1, N: 17
  
- Group will continue to consider auto-negotiation.



# Congestion Management

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- **Straw Poll:** Should an objective to address congestion management be added to this project?
  - Y: 7, N: 22
- **Straw Poll:** Should congestion management be addressed within 802?
  - Y: 32, N: 0
- **Motion:** The BESG recommends that an 802.3 Study Group be established to continue the evaluation of Layer 2 enhancement for congestion management for Backplane Ethernet.
  - Passes (36/1/3, dot3 17/1/0 )



# SG Motions

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- In all Objectives change references to “FR-4” to “Improved FR-4.”
  - Passed by unanimous voice vote.
- In all Objectives change references to “40 inches” to “1m”
  - Passed by unanimous voice vote.
- In Objectives, change “Support BER of 1E-12” to “Support of BER of better than 1E-12.”
  - Failed (14/16, dot3 6/2)
- The BESG recommends that an 802.3 Study Group be established to continue the evaluation of Layer 2 enhancement for congestion management for Backplane Ethernet.
  - Passes (36/1/3, dot3 17/1/0 )
- Move that the Backplane Ethernet Study Group adopt the Backplane Ethernet Objectives as revised. (To be posted as objectives\_1\_0304.pdf)
  - Passes ( 30/0/0, dot3 10/0/0 )



# SG Motions (continued)

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- Move that the Backplane Ethernet Study Group request approval of the Backplane Ethernet Objectives document, per objectives\_1\_0304.pdf, by the 802.3 WG.
  - Passed (27/0/0)
- Move that the Backplane Ethernet Study Group request approval of the Backplane Ethernet 5 Criteria document, per critters\_1\_0104.pdf, by the 802.3 WG.
  - Passed (35/0/0)
- Move that the Backplane Ethernet Study Group request 802.3 approval of the Backplane Ethernet PAR document, as submitted to 802.3 and the Executive committee.
  - Passed (37/0/0)
- Move that the Backplane Ethernet Study Group be extended and request the 802.3 WG to approve Backplane Ethernet Interim meeting(s).
  - Passed (38/0/0)





# Motion (Objective Approval)

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- Move that 802.3 approve the Backplane Ethernet Objectives document, per objectives\_1\_0304.pdf.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 56/0/3
- MOTION PASSES



# Backplane Ethernet Objectives

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- **Preserve the 802.3/Ethernet frame format at the MAC Client service interface.**
- **Preserve min. and max. frame size of current 802.3 Std.**
- **Support existing media independent interfaces.**
- **Support operation over a single lane across 2 connectors over copper traces on improved FR-4 for links consistent with lengths up to at least 1m.**
  - **Define a 1 Gb/s PHY**
  - **Define a 10 Gb/s PHY**
- **Consider auto-negotiation.**
- **Support BER of 1E-12.**
- **Meet CISPR/FCC Class A.**

# Backplane Ethernet Objectives (ammended)

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- Preserve the 802.3/Ethernet frame format at the MAC Client service interface.
- Preserve min. and max. frame size of current 802.3 Std.
- Support existing media independent interfaces.
- Support operation over a single lane across 2 connectors over copper traces on improved FR-4 for links consistent with lengths up to at least 1m.
  - Define a 1 Gb/s PHY
  - Define a 10 Gb/s PHY
- Consider auto-negotiation.
- Support BER of  $10^{-12}$  or better.
- Meet CISPR/FCC Class A.



# Motion (Broad Market Potential Approval)

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- Move that 802.3 approve the Backplane Ethernet 5 Criteria, Broad Market Potential, per critters\_1\_0304.pdf.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 46/0/3
- MOTION PASSES



# Broad Market Potential

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**Broad set(s) of applications**

**Multiple vendors, multiple users**

**Balanced cost (LAN vs. attached stations)**

- **Ethernet has become widely deployed as a preferred backplane solution. Examples include Modular Servers and Enterprise and Telecom Network Equipment. Quantitative presentations have been made to the 802.3 Backplane Ethernet Study Group indicating significant market opportunities for these applications.**
- **Rapid growth of network and internet traffic is driving the need for higher performance over backplanes. Currently, IEEE 802.3 does not address this application with a formal standard.**
- **156 participants attended the Ethernet Over Backplane call-for-interest, representing at least 33 companies, and indicated that they plan to participate in the standardization of Ethernet Over Backplane. This level of commitment indicates that a standard will be developed by a large group of vendors and users.**
- **A standardized Ethernet interface on blades will maintain the balanced cost for backplane applications.**



# Motion (Compatibility Approval)

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- Move that 802.3 approve the Backplane Ethernet 5 Criteria, Compatibility with IEEE Std 802.3, per critters\_1\_0304.pdf.
  
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 53/0/1
- MOTION PASSES



# Compatibility with IEEE Std. 802.3

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**Conformance with CSMA/CD MAC, PLS**

**Conformance with 802.2**

**Conformance with 802**

- **The proposed standard will conform to the 802.3 MAC, and therefore will be consistent with 802.1D, 802.1Q, and relevant portions of 802.1f.**
- **As was the case in previous 802.3 standards, new physical layers will be defined.**
- **The proposed standard will conform to the 802.3 MAC Client Interface, which supports 802.2 LLC.**
- **The proposed standard will conform to the 802.1 Architecture, Management and Interworking.**
- **The proposed standard will define a set of systems management objects which are compatible with OSI and SNMP system management standards.**
- **The proposed standard will conform to the requirements of IEEE Std 802-2001.**



## Motion (Distinct Identity Approval)

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- Move that 802.3 approve the Backplane Ethernet 5 Criteria, Distinct Identity, per critters\_1\_0304.pdf, as ammended.
  
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 51/0/1
- MOTION PASSES





# Distinct Identity

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**Substantially different from other 802 and 802.3 specifications**

**One unique solution for problem**

**Easy for document reader to select relevant spec.**

- **The current 802.3 specification does not explicitly cover backplane transmission. XAUI is for chip-to-chip applications. 10GBASE-CX4 is for box-to-box (cabling) applications. 1000BASE-X has no electrical specification, and 1000BASE-CX is specified for coaxial cable.**
- **The standard will define a single PHY for each speed of operation.**
- **The specification will be done in a format consistent with the IEEE document requirements thus making it easy for implementers to understand and design to.**
- **The proposed specification will use copper media similar to other high speed networking technologies (Fibre Channel, IB4X) but does so with the IEEE 802.3 MAC as the over-riding layer which will result in higher compatibility and lower cost for Ethernet systems.**



# Distinct Identity (ammended)

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Substantially different from other 802 and 802.3 specifications

One unique solution for problem

Easy for document reader to select relevant spec.

- **The current 802.3 specification does not explicitly cover backplane transmission. XAUI is for chip-to-chip applications. 10GBASE-CX4 is for box-to-box (cabling) applications. 1000BASE-X has no electrical specification, and 1000BASE-CX is specified for coaxial cable.**
- **The standard will define at most one PHY for 1Gb/s operation and at most one PHY for 10Gb/s operation.**
- **The specification will be done in a format consistent with the IEEE document requirements thus making it easy for implementers to understand and design to.**
- **The proposed specification will use copper media similar to other high speed networking technologies (Fibre Channel, IB4X) but does so with the IEEE 802.3 MAC as the over-riding layer which will result in higher compatibility and lower cost for Ethernet systems.**



# Motion (Technical Feasibility Approval)

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- Move that 802.3 approve the Backplane Ethernet 5 Criteria, Technical Feasibility, per critters\_1\_0304.pdf.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 51/0/1
- MOTION PASSES



# Technical Feasibility

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**Demonstrated system feasibility**

**Proven technology, reasonable testing**

**Confidence in reliability**

- **Ethernet MAC and interfaces are being used in backplane applications today.**
- **Technical presentations, given to the Backplane Ethernet Study Group, have demonstrated the feasibility of using copper backplane topologies at data rates up to 10 Gb/s per lane using available technologies. Other organizations are developing specifications for backplane applications for similar data rates.**
- **The principle of extending higher speeds to copper media has been well established by previous work within 802.3. The Backplane Ethernet work will build on this experience.**
- **Vendors of higher speed components are building reliable products which operate at data rates up to 10 Gb/s per lane on backplanes, and meet worldwide regulatory and operational requirements.**



# Motion (Economic Feasibility Approval)

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- Move that 802.3 approve the Backplane Ethernet 5 Criteria, Economic Feasibility, per critters\_1\_0304.pdf.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 49/0/1
- MOTION PASSES



# Economic Feasibility

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**Cost factors known, reliable data**  
**Reasonable cost for performance**  
**Total installation costs considered**

- **The component costs will benefit from cost reduction associated with Moore's Law. Further integration of functionality will reduce cost.**
- **Costs for backplanes based on available materials and components are well known and reasonable.**
- **Ethernet backplane standardization will increase deployment and diversity of supply base to further reduce cost.**
- **Ethernet IP re-use will lower implementation cost.**
- **System design, installation and maintenance costs are minimized by utilizing Ethernet system architecture, management, and software.**



## Motion (5 Criteria Approval)

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- Move that 802.3 WG forward the Backplane Ethernet 5 Criteria to the 802 SEC for approval.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 47/0/0
- MOTION PASSES



## Motion (PAR)

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- 802.3 WG approve the Backplane Ethernet PAR, as per par\_0104.pdf, and forward the PAR to the 802 SEC and NesCom for approval (please consider for approval under continuous process).
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 55/0/0
- MOTION PASSES





## Motion (Extend)

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- Move that 802.3 extend the Backplane Ethernet Study Group.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): Unanimous by voice
- MOTION PASSES



## Motion (New Study Group)

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- IEEE 802.3 authorize the formation of a Study Group to develop a standards project proposal (PAR and 5 Criteria) for Layer 2 enhancements for congestion management for Backplane Ethernet.
- TECHNICAL (75%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A):
- MOTION PASSES/FAILS
- Motion to amend...



## Motion (New Study Group - amended)

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- IEEE 802.3 authorize the formation of a Study Group to develop a standards project proposal (PAR and 5 Criteria) for Layer 2 enhancements for congestion management **including the needs of** Backplane Ethernet.
  
- Motion to Amend, Y: 14, N: 10, A: 0



## Motion (New Study Group - amended)

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- IEEE 802.3 authorize the formation of a Study Group to develop a standards project proposal (PAR and 5 Criteria) for Layer 2 enhancements for congestion management including the needs of Backplane Ethernet.
  
- PROCEDURAL (50%)
- Moved – A. Healey on behalf of the Study Group
- Second – N/A
- 802.3 Voters (Y/N/A): 23/18/15
- MOTION PASSES



# Future Meetings

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- May 2004 Interim:
  - Week of the 24th
  - Long Beach/Monterey, CA
  - Co-located with 10GBASE-T, ...
  
- July 2004 Plenary
  - Week of the 12th
  - Portland, OR
  - Portland Hilton



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Thank You!



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# Backup



# “Improved FR-4”

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- FR-4 indicates “Flame retardant type 4 woven glass reinforced epoxy resin system.”
  - Includes FR402/4000-2, GETEK, 4000-13, 4000-13SI, FR408, Isola 620, etc.
  - Typical Dk ranges from 3.5 to 4.3
- “Improved FR-4” refers to materials in the class FR-4 that optimizes solution complexity and system cost (at 1m).
- Channel model group given guidance for initial assumptions regarding material properties (Dk and Df)
- Refer to [goergen\\_2\\_0304.pdf](#) for additional information.



## ■ Title

- Information technology -- Telecommunications and information exchange between systems -- Local and metropolitan area networks -- specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications Amendment: Ethernet Operation Over Electrical Backplanes

## ■ Scope

- The scope of this project is to specify additions to and appropriate modifications of IEEE Std 802.3 to specify operation at 1000 Mb/s and 10 Gb/s across an electrical backplane leveraging the existing MAC.

## ■ Purpose

- The purpose of this project is to provide standards based Ethernet interconnection of server and telecommunication blades over a modular platform backplane. Industry trends for LAN, SAN and other applications are migrating to backplane interconnects, and this project will optimize Ethernet operation for backplanes